Irish GDP Growth in 2015: A Puzzle and Propositions for a Solution

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Abstract – In July 2016, the Irish statistical institute significantly revised GDP annual growth in 2015 from 7% to 26%. This revision does not correspond to a similar increase in employment nor in the accumulation of new physical capital, but to the relocation of preexisting intangible assets by multinationals to Ireland. This article provides a comprehensive depiction of the effects of these relocations on the Irish GDP and balance of payments in 2015. We question the need to change the accounting standards defining the macroeconomic aggregates and the framework for economic analysis. We conclude that an effort to adapt and revamp the standards of national accounts is thus necessary to achieve a consistent recording of multinationals' transactions, crucially by clarifying the concept of economic ownership over production and intellectual property and then by facilitating its implementation.

JEL Classification: E01, F20, F40, F62
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In July 2016, the Central Statistics Office (CSO) significantly revised the Irish GDP growth in 2015 from 7% to 25.6% (CSO, 2016a). This upward revision has not been matched by a similar revision of employment nor of the accumulation of physical capital. Rather than stemming from new production capacities, it results mainly from the relocation of preexisting and intangible assets (research and development, software, etc.), worth €300 billion, by a small number of large multinationals enterprises (MNE) within their Irish legal units. This episode calls into question the principles and the rules according to which national accountants assign production to a territory, in a context of rapid movements of assets from one region of the world to another.

To begin with, the amount of intangible assets relocated in Ireland in 2015 was sufficiently sizable to have dramatic and indirect macroeconomic consequences on the Irish economy. Ireland, referred to as the "Celtic Tiger" in the 1990s, is a small and open economy. In 2008-2009, Irish banks were severely affected by the financial crisis in the wake of the collapse of the real-estate bubble. Since 2010, the Irish economy has recovered progressively driven by stronger exports. Foreign-owned subsidiaries accounted for approximately 70% of industrial production, 60% of exports of goods, 40% of exports of services and 60% of imports of services in 2015. Before 2015, employment was roughly in line with GDP. However, in 2015, compared to the sudden GDP growth, no paralleling shift in the employment level occurred.[1]

Another feature of Ireland is the tax and legal environment surrounding intangible assets. On one hand, the Irish tax system is the most favorable to companies in European Union (EU) and also, in 2015, compared to the US tax system.[2] This tax system is favorable to the establishment of MNE and to the relocation of intangible assets in Ireland. Since 2009, Ireland broadly extended the class of intangible assets eligible to a capital allowances scheme that enables companies to deduct their expenditure on the acquisition of eligible intangible assets from their taxable income, even when these assets are acquired from related parties (i.e. group subsidiaries). In 2015, to tackle tax avoidance schemes such as the "Double Irish with a Dutch sandwich" double non-taxation scheme, Ireland passed measures in the 2015 budget to close those loopholes.[3] However, the extension of the scope of the capital allowance for intangible assets has allowed a 0% effective tax rate on the associated income.[4] The Irish tax system is also particularly attractive for research and development (R&D), via a tax credit of 25%, and thanks to a patent box (the "Knowledge Development Box") that allows companies to deduct from their taxable income the product derived from their patents and then tax them at the rate of 6.25% (instead of the statutory rate of 12.5%).

On the other hand, the legal protection of income, the membership to the EU common market and the euro area, also confer Ireland advantages in terms of market access and regulation, per se and over offshore centres and tax havens (see e.g. Raspiller, 2005). In October 2015, personal information on European consumers was the subject of significant European regulatory attention. In particular, the European Court of Justice invalidated the automatic exchange procedures under the safe harbor regime, considering that European consumer data in the United States (US) were not sufficiently protected under current European standards. This trend has intensified, as highlighted by the 2016 General Data Protection Regulations. These developments in digital regulation are changing the relative attractiveness of each country for locating intangible assets in or outside the EU. This has in turn provided further incentives for US MNEs to strengthen their data processing activities within subsidiaries located in the Single Market. The same applies to other regulatory aspects specific to the EU market (pharmaceutical products, transport services, etc.). These elements add up so that Ireland is considered by some MNEs as an optimal place to register business in Europe, especially in case of intensive use of intangible assets.

The national accounting mechanisms at work in Ireland in 2015 are summarized below: a limited number of MNEs have transferred mainly intangible assets[5] and aircraft, from their balance sheets to resident units in Ireland. These transfers of assets and liabilities have deteriorated Ireland's external position. In return, these Irish resident units have become owners

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1. Irish unemployment gradually decreased as the unemployment rate fell from 15% to 5% between 2010 and 2019 but no sharp decrease occurred in 2015.

2. The statutory corporate tax rate in Ireland is 12.5% compared to an average of around 22% for the European Union (European Commission, DG TAXUD, 2018).

3. By ending the use of this scheme for new tax plans, and implementing a staggered ban for established structures. Following the announcement, companies could still implement such a scheme during a three-month window.

4. In the 2015 budget, while the double Irish tax scheme ended, the 80% rule was abolished so firms could claim tax relief on up to 100% of profits from their Intellectual Property investment (Taylor, 2017).

5. These include R&D or commercial patents, trademarks, etc.

of MNEs' international production. They then receive payments generated from the production they own. This has led to a substantial increase in Irish exports and to a lesser extent in Irish imports, because these Irish units are remunerated directly from the proceeds of the sale of goods or services produced abroad traded under contract manufacturing. The sharp increase in the exports of goods by Irish resident units is recorded even though these goods are materially produced in the rest of the world and never crossed the Irish border.[6] As a result, the Irish resident units themselves have also been a source of income for the non-resident units, which ultimately own them and which had transferred the associated intangible assets to them in the first place. Property income payed to the rest of the world has also increased. Indeed, Ireland benefits on the one hand from the proceeds of the sales of products it now owns, and on the other hand pays dividends or reinvested profits to non-resident shareholders. These profits are also partly reused to reconstitute of the intangible capital newly recorded on the companies' balance sheets, leading to an increase in Gross Fixed Capital Formation (GFCF). All these changes could be observed because of the modest size of the Irish economy[7] and, conversely, the significant size of transfers. The first-rank counterparts of the asset transfers are not directly identifiable in the available statistical sources. To track "phantom" investments, these statistics need to be supplemented with data on global interconnections (Damgaard *et al*., 2019), including for tax havens.

The contribution of this paper is twofold. First, it provides a comprehensive and as detailed as possible picture of national accounts and balance of payments developments as well as GDP growth in Ireland in 2015. Its novelty is to trace the impact of the relocation of intangible assets on GDP and more generally on national accounts and the balance of payments. Second, without alternatives, we infer that a change in national accounting standards should occur to deal with the kind of episodes that happened in Ireland. This overhaul of accounting guidelines should be pursued, aimed at allocating multinationals' revenues from intellectual property to countries on the basis of economic considerations.

The paper is structured as follows. The first section presents GDP developments between 2014 and 2015 according to "expenditure" and "income" approaches and to what has triggered these unusual developments. The second section presents how national accounting principles assign economic activity to a territory and to which extent the Irish case challenges these underlying principles of national accounting. In particular, we highlight the role of economic property as a fundamental concept of national accounts. The third section reviews four solutions that have emerged so far: *i)* the release of complementary indicators such as the modified gross national income (GNI*) of the CSO; *ii) ex post* correction using formulary apportionment; *iii)* a change in national accounting rules; and finally *iv)* the enrichment of GDP modeling in the field of macroeconomics to better account for intangible capital as a production factor. In particular, we summarize the pros and cons of those four ways forward after the Irish case.

1. Investigating the Developments of the 2015 National Accounts and Balance of Payments

According to the CSO's publication July 2016, GDP in 2015 increased by 34.7% in value and 25.6% in volume terms. This development immediately seemed «abnormal» to observers (see e.g. Krugman, 2016). First, it contrasts with the pace of Irish GDP growth over the recent period. In comparison, growth was 1.6% between 2012 and 2013, then 8.3% between 2013 and 2014. Secondly, it is not caused by a positive shock in the domestic demand (higher public spending, higher consumption, etc.). On the financial side, the determinants of production (interest rates, oil prices, exchange rates) are close or identical to those observed in the euro area. Finally, this GDP increase does not translate into an increase in income for Irish households. This change in GDP reflects a sharp increase in trade balance that has no equivalent in other European countries.[8] The methodological notes gradually published by the CSO nevertheless highlighted the consistency of this evolution with that of the balance of payments without providing the full picture because of the rules of statistical secrecy. A detailed analysis of the developments in the components of GDP, GNI and Ireland's international investment position is thus presented.

6. For example, a smartphone or medicine are not necessarily owned by the industrial unit, which manufactures them. They are rather owned by the multinational company that immediately controls their marketing and that can allocate ownership right among its other units.
7. Ireland's GDP represents almost 2% of the euro area's GDP.
8. The public finance situation has been under surveillance since the 2007-08 crisis, with Ireland being one of the countries that received assistance from the European Union and the IMF due to the sharp increase of the deficit and public debt, which itself resulted from bank failures.

1.1. Demand Components Developments

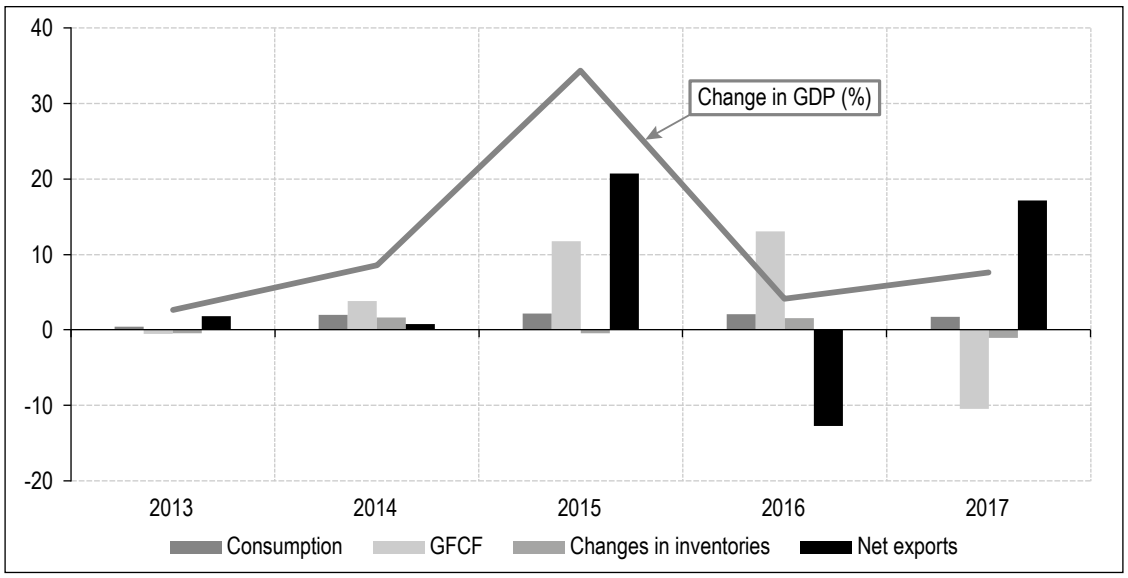
Two thirds of the increase in GDP in value between 2014 and 2015 is explained by Ireland's trade in goods and services, which contributes almost 21 points (Figure I). In addition, the GFCF's contribution to GDP growth amounts to 12 points. It also continued in 2016 and was followed by a backlash in 2017. Higher foreign trade and the increase in GFCF therefore substantially altered the composition of GDP in level and in terms of dynamics. In 2016 and 2017, the volatility of the demand components increased because their profile is more closely linked to the decisions of MNEs whose weight is now higher. The subsidiaries of resident MNEs in Ireland and hosting these balance sheet transfers received the export and import proceeds of goods whose production requires the assets they hold. Consequently, the expenses and income of the international production in which they participate were assigned to these units.

1.1.1. Exports and Imports without Border Crossings Due to Contract Manufacturing

This increase in imports and exports does not correspond to trade in physical goods but to margins made abroad and integrated into trade in goods. More specifically, most of the change in Ireland's trade balance in national accounts comes from the increase in trade adjustments, from cross border basis to ownership basis, including "goods for processing" and "contract manufacturing". Contract manufacturing occurs when a domestic company hires a company abroad to manufacture products on its behalf (and vice versa). These products could be either finished or semi-finished products, part of a value-chain. Crucially, the inputs and output in this production process remain in the ownership of the domestic entity and a change of economic ownership is not deemed to occur during this subcontracting process. Indeed, the foreign contract manufacturer supplies a manufacturing service to the Irish entity and never takes ownership of the product being product (CSO, 2016b).

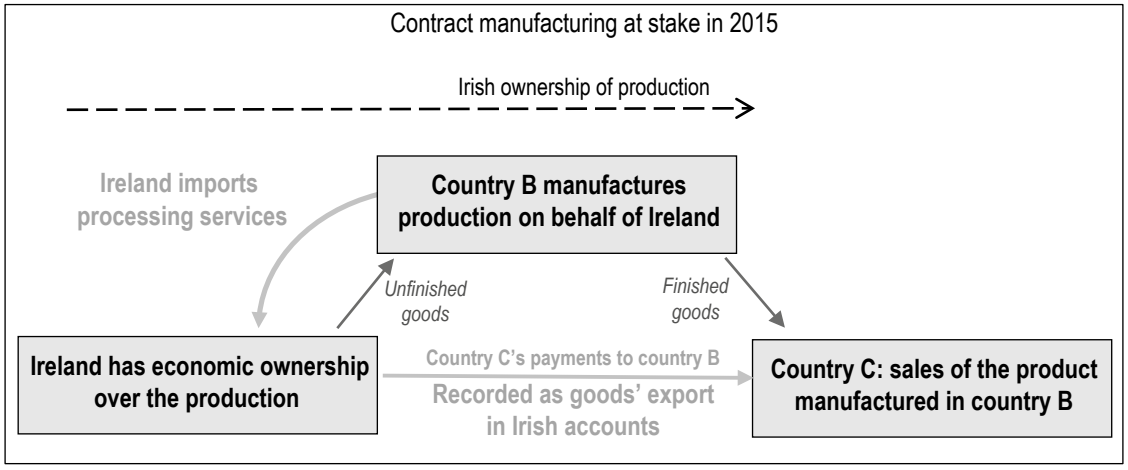
As an example, contract manufacturing occurs in the electronics sector when the originator provides the inputs of smartphones and the sub-contractor manufactures the finished goods. The flow chart in Figure II details the case of goods purchased, processed, and sold abroad underlined in the Economic Statistics Review Group (ESRG) report (2016). A resident unit in Ireland, part of a global production process, receives sales products of the goods manufactured abroad. The export is only recorded when a change of ownership occurs with the sale in Country C. In detail, inputs are purchased from abroad by the Irish company; the materials are sent and transformed into final goods by the processor (in country B), possibly using intangible assets or services that belongs to the Irish unit; the physical goods are then sold to the final consumer (in country C) without ever

Figure I – **Gross domestic product and main aggregates (variation in value and contributions in percentage points)**



Sources: CSO, National Accounts.

Figure II – **Exports of contract manufacture when the economic ownership is located in Ireland**



Notes: The diagram shows how, starting from trade data (in italics), balance of payments adjustments (in grey, bold): increase the goods' export value to the final sale value; may increase the goods' import value by the cost of material inputs delivered directly to country B for incorporation into production; and record imports of processing services in Ireland.

entering Ireland. The Irish company makes a profit as the owner of the product and possibly providing intangible assets (trademark, design, etc.) into the process. This profit enters the value added.

From a national accounts standpoint, production physically carried out abroad is considered as Irish production as long as an Irish resident unit has ownership, and the income from the sale of this production is thus recorded in the Irish GDP (see Section 2). Ireland's goods for processing and contract manufacturing exports increased by €60 billion between 2014 and 2015, accounting for more than two thirds of the increase in Irish exports in goods (+€86 billion in exports of goods). These levels were maintained in 2016 and 2017 (Table 1). Among these adjustments, €17 billion pertain to adjustments to goods exports to China in 2017.

Conversely, Ireland's trade balance in services is deteriorating sharply, with imports of services increasing by €53 billion while exports of services are growing by €20 billion (Table 2). In particular, imports of R&D services increase by €20 billion. This corresponds to the net acquisition of additional intellectual property products (IPP). Moreover, imports of royalties and license fees for the use of intellectual property rights are also increasing by more than €20 billion. Irish resident units therefore increased their payments of royalties and license fees to non-residents in return for permission to use intellectual property rights (patents, copyrights, trademarks, industrial

Table 1 – **From customs data to national accounts (in billions of euros)**

		2013	2014	2015	2016	2017
International trade (Cross-border basis)	Exports	89.2	92.6	112.4	117.6	122.5
	Imports	55.8	62.2	70.1	72.1	76.7
+ Goods for processing	Exports	7.1	18.6	78.6	67.6	64.7
	Imports	7.2	10.2	13.6	11.6	5.6
+ Net exports of goods under merchanting	Exports	3.7	3.5	6.4	5.3	7.6
+ Other conceptual adjustments	Exports	-1.3	-0.2	2.9	3.6	-1.9
	Imports	1.3	1.3	3.2	4.5	3.0
Merchandise (Ownership basis)	Exports	98.7	114.5	200.3	194.1	192.9
	Imports	64.2	73.7	86.9	88.2	85.2

Notes: This table breaks down the transition of customs data, which measures international trade in goods when crossing the Irish border, to imports and exports according to national accounts (i.e. based on the change in ownership criterion).
Sources: CSO, Trade statistics and National Accounts.

Table 2 – **Exports and imports of services (in billions of euros)**

		2014	2015	2016	2017
All services	Exports	99.9	120.2	135.1	161.8
	Imports	105.4	158.0	198.8	205.3
Insurance and Financial services	Exports	19.2	22.8	22.6	25.3
	Imports	13.3	17.4	18.2	19.9
Computer services	Exports	42.0	50.4	58.1	68.1
	Imports	0.6	1.1	1.4	3.2
Royalties and licence fees	Exports	5.2	7.3	8.1	9.1
	Imports	43.3	63.8	69.2	66.7
Research and developement services	Exports	2.3	1.8	4.0	6.7
	Imports	8.7	28.2	58.1	55.2
Other services not elsewhere stated	Exports	31.2	37.9	42.4	52.6
	Imports	39.5	47.5	51.9	60.4

Sources: CSO, Balance of Payments.

processes, etc.) or to use originals or prototypes produced (manuscripts, paintings, etc.) under licensing agreements.

The growth of imports of R&D services reflects that MNEs reshuffled the allocation of property and use of intangibles in 2015. R&D imports are recorded in case of outright results of different activities (patents, copyrights, etc.), which by the way renders royalties and license fees payments to use those intangible assets unnecessary. For example, cost-sharing agreements between a Irish resident unit and a US R&D centre, which are pointed to as a means to transfer intellectual property products quickly and at virtually no cost, enable Irish resident units to get ownership on IPP developed in the US provided the formers pay a fee to US units, covering for the R&D development costs. This fee is then also recorded as R&D import. This mechanism was at play in 2015 in Ireland, within MNEs (Richard Harvey, 2020; Coffey, 2018) and specifically *Apple* (Brehm Christensen & Clancy, 2018) contributing to the increase in R&D imports. R&D imports development in 2015 is then offset by investment developments, resulting in no effect on GDP. However, intangible assets that were relocated in 2015 by some MNEs were transferred to units before they became resident in Ireland and the relocation was in this case not recorded as R&D imports and matching investment, but as change of volume, see below. Royalties and license fees (which when imported, correspond to payments made by an Irish resident unit to overseas against the right to use IPP it does not own), also increased by €20 billion in 2015. This hints at the fact that some Irish firms might be continuing to use foreign intellectual property, but this increase is in line with the trend observed in the years prior to 2015.

1.1.2. The Current Account

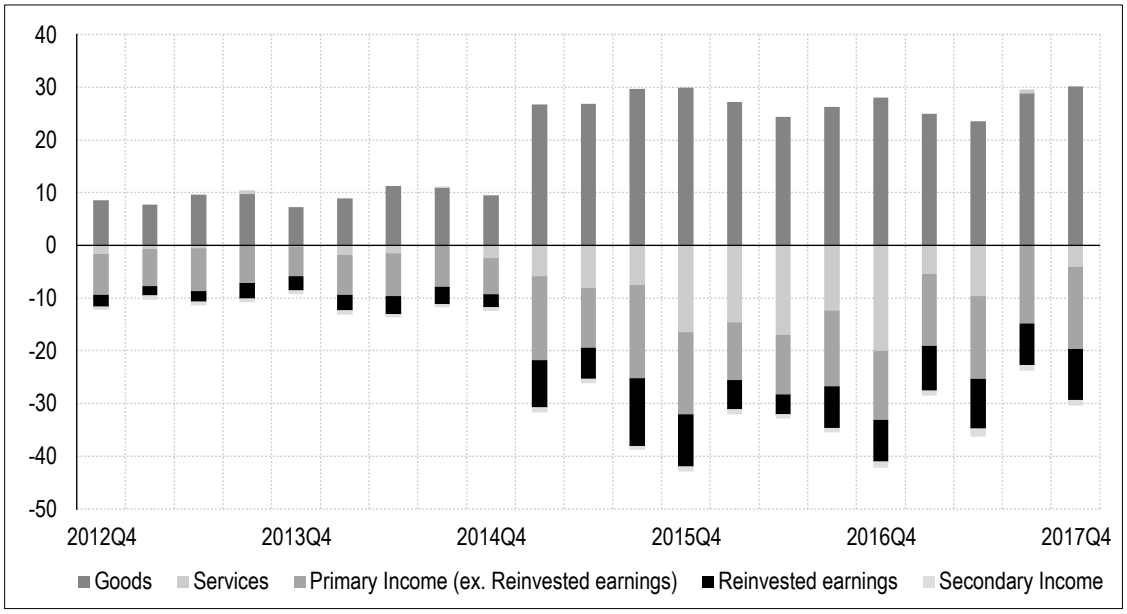
Figure III shows the current account of Ireland mirroring goods, services, primary and secondary income balances. As explained above, the balance of trade in goods improved in 2015 since Irish subsidiaries had become owners of goods traded under contract manufacturing. The increase in imports of R&D services, and, to a lesser extent, royalties, explains the degradation of the balance of trade in services. Besides, the net primary income balance,[9] which measures transfers of income between resident and non-resident institutional units remunerating the provision of labor or capital (wages of cross-border workers, flows of interest or dividends on securities held by non-resident agents, etc.), deteriorated by almost €30 billion between 2014 and 2015, as investigated below.

1.2. Income Developments

The analysis of the sequence of income also enables to identify the main mechanisms at work, and to better understand the deterioration of the net primary income balance. At current prices, Irish GDP rose from €195.3 billion in 2014 to €262.5 billion in 2015, a variation of €67 billion compared with €15 billion between 2013 and 2014 (Table 3).

9. This balance is defined as income received by resident institutional units in the rest of the world, minus income paid by resident institutional units to non-resident institutional units.

Figure III – **Ireland's current account (flows in billion euros)**



Sources: CSO, Balance of Payments.

Several observations can be drawn from this sequence of accounts. GNI is equal to GDP plus primary income flows received from abroad and minus primary income flows paid abroad (i.e. the net factor income, see Box). In Ireland, the increase in GNI growth is less pronounced than GDP, but still significant (€37 billion), and triggers a matching increase in gross national disposable income (GNDI). This means that almost 40% of the increase in GDP involves Irish resident units that are owned by the rest of the world, and that it is re-payed by those resident units to their final owner overseas. This payment does not need to effectively take place in the form of dividends: profits "reinvested in the subsidiaries" (i.e. undistributed) are also recorded as outflows. However, even if reinvested earnings mainly appear as outflows, a fraction of these reinvested earnings corresponding to depreciation (recorded as consumption of fixed capital) still remains parked within the Irish resident units by convention (see Online Appendix C1-A – link to Online appendices at the end of the article). The income outflows corresponding to the reinvested profits are reduced by the amount of fixed capital consumption. Provisions for depreciation indeed increased by €27 billion in 2015, explaining two thirds of the increase in GNI.

The analysis of income developments shed light on the distortion of usual links between macroeconomic aggregates. GNDI was not consumed in the usual proportions that existed before 2015.

Table 3 – **GDP and use of gross national disposable income (billions of euros at current prices)**

	2013	2014	2015	2016	2017
Gross domestic product (a)	179.9	195.3	262.5	273.2	294.1
Net factor income from the rest of the world (b)	-28.1	-30.4	-60.8	-50.1	-59.9
Gross national income (c =a+b)	151.8	164.9	201.7	223.2	234.2
Current transfers from the rest of the world (d)	-2.9	-2.7	-3.3	-3.6	-4.5
Gross national disposable income (e= c+d)	148.9	162.2	198.3	219.5	229.7
Total consumption expenditure (f)	111.3	114.9	119.2	124.7	129.5
Gross national savings (g= e-f)	37.6	47.3	79.2	94.8	100.3
Provision for depreciation (h)	26.7	28.8	56.5	63.9	72.0
Net national savings (i=g-h)	10.9	18.4	22.7	30.9	28.3

Sources: CSO, National Accounts.

Box - **Key identities of National accounts and Balance of payments**

In the following, the crucial transactions in the Irish case are marked with stars and a companion explanation is provided.

National accounts are based on the three approaches of GDP:

Income approach

GDP = compensation of employees + gross operating surplus* + gross mixed income + (taxes - subsidies) on production and imports

* Extra profits have been recorded by resident companies in Ireland

Expenditure approach

GDP = consumption + investment* + government spending + net exports of goods and services**

*Investment refers to gross fixed capital formation, which in particular includes depreciation on the capital stock, also known as consumption of fixed capital

** Exports of goods includes contract manufacturing. Import of services includes R&D services

Production approach

GDP = gross value added* + (taxes - subsidies) on production and imports

* The surge in value added is mainly recorded as manufactured production

The **Gross National Income (GNI)** is derived from the GDP. In Ireland, the GNI is inferior to the GDP by around €50 billion in 2015. The income outflows, mainly due to foreign MNEs which established subsidiaries in Ireland, far exceeds income that Irish resident units derive from investment abroad.

Gross national income

GNI = GDP + net primary incomes (interest, dividend, reinvested earnings and other primary income)*

* 'Primary income' less 'Other primary income' = 'Net Factor Income' mentioned in the paper

The Balance sheet account

The estimates of the stock of assets (K(t)) are usually computed with the Perpetual Inventory Method. We report here the law of motion of capital to clarify that relocations of assets would enter as an 'Other change in volume' in the sequence of accounts.

K(t) = K(t-1) - depreciations(t) + investment(t) + other change in volume(t)

The Balance of payments records all transactions made between entities in one country and the rest of the world. Balance of payments is consistent with the 'Rest of the world' sector in national accounts.

Current account (CA)

CA = net exports + net primary incomes* + net secondary incomes

CA = national savings - national investment

Financial account (FA)

FA= net acquisition of financial assets* - net acquisition of financial liabilities*

* Foreign direct investments, portfolio investments and other investments

Capital account (KA), defined such that:

KA + CA + FA =0

Net international position (NIPP)

NIPP(t) = NIPP(t-1) + current account (t) + other change in volumes* (t) + valuation effects (t)

*Relocation of assets recorded in the 'Other change in volumes' is, in the Irish case, similar to the asset side

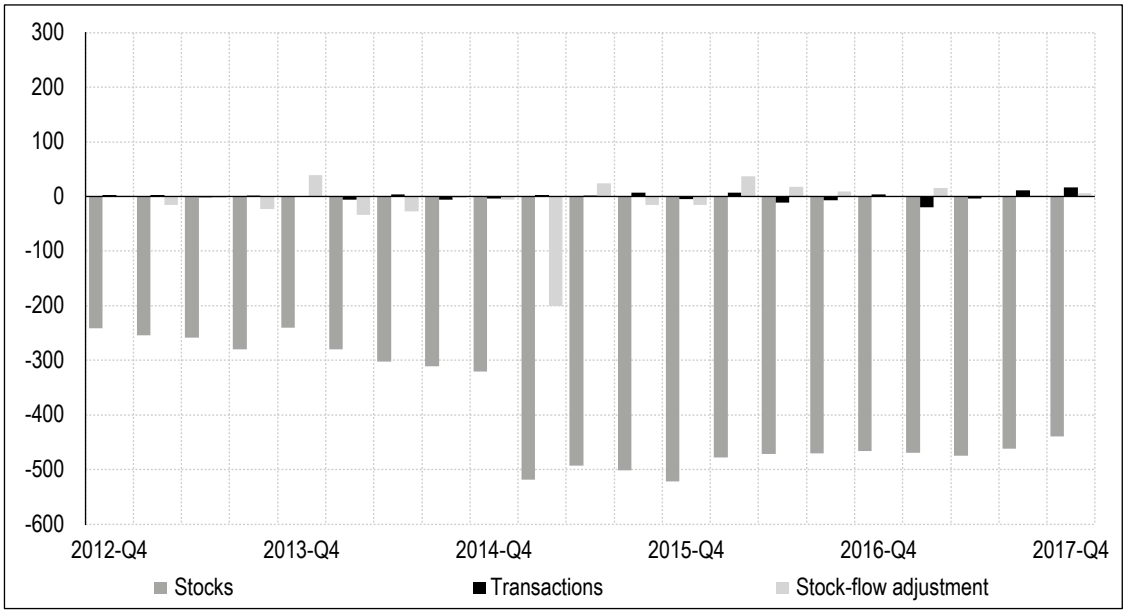
In 2014, final consumption represented 71% of the GNDI, this ratio was only 60% in 2015. The increase of disposable income by €36 billion in 2015 mainly led to an increase in national savings of €32 billion, including €27 billion hoarded by companies in the form of 'Provisions for depreciation', with virtually no impact on consumption. In total, the "new" value added gives rise essentially to two types of transactions involving Irish resident companies: repayment to foreign units and, above all, provisions for depreciation.

1.3. The Relocation of Assets as a Trigger

In total, €300 billion of intangible assets were transferred from the rest of the world to Ireland (ESRG, 2016, p. 8). Consistently, from 2014 to 2015, the external position recorded financial counterparts of net assets transfers as a stock-flow adjustment (more precisely a change in volume). Because those net assets were not newly produced, they are not recorded as an economic transaction (i.e. not as GFCF). Overall, these relocations led to a net decrease of €200 billion in Ireland's external position in the first quarter of 2015 (Figure IV).

The variations in Irish GDP in 2015 stemmed from the relocation of intangible assets from the rest of the world to Ireland. This may seem paradoxical because asset transfers via stock-flow adjustment do not constitute production as such. However, the relocation of intangible

Figure IV – **Ireland's international investment position (in billions of euros)**



Notes: The dark grey bars show the quarter stocks of foreign assets and liabilities. The difference between two end-quarter positions can be transactions (in black) or the impact of other changes in volumes and valuation (in light grey) occurring in the same period.
Sources: CSO, Balance of Payments.

assets indirectly affects GDP: with respect to the expenditure approach to GDP, those assets gave to Irish resident units economic ownership over some new goods, which led to an increase in net exports after accounting for contract manufacturing adjustments. To replenish the stock of intangible assets required, additional GFCF has to be carried out to offset the high share of depreciations.

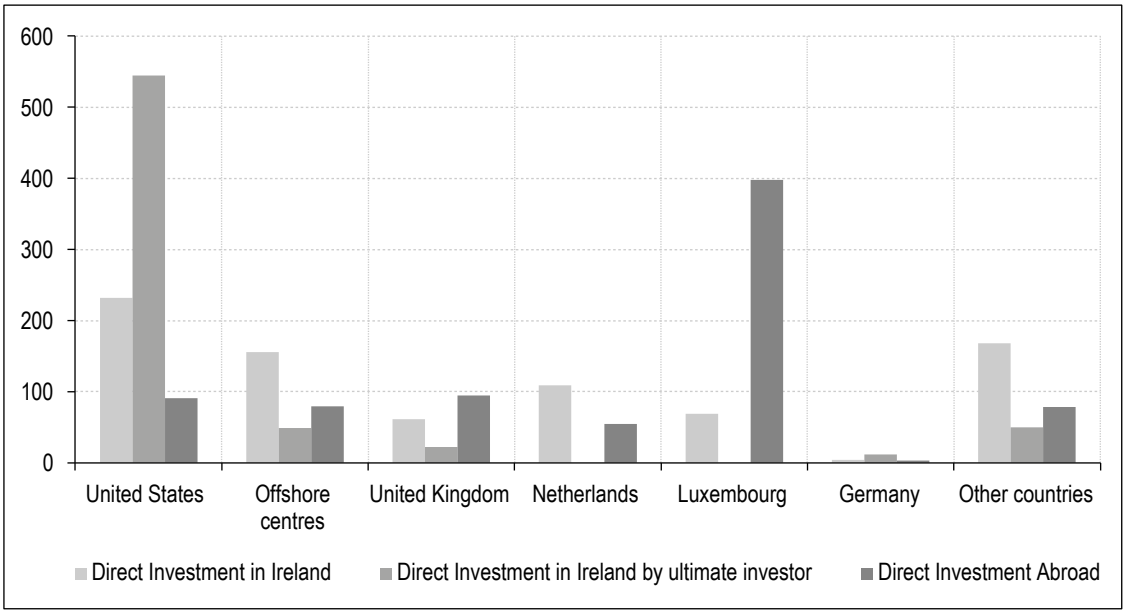
To understand the origin of these developments, we would want to access the geographical breakdown of the international investment position. The deterioration of net external position results mainly of portfolio investments[10] for which no geographical breakdown is available. At the same time, foreign direct investment assets and liabilities also increased dramatically, and the geographical origin of the direct investment stock is publicly available. The main direct counterpart countries are the US (€232 billion), Luxembourg (€69 billion), the Netherlands (€54.8 billion) and various offshore centres (€156 billion). These direct inward investments represent liabilities of Irish resident units that correspond to the financial first-rank counterparts of the intangible assets relocated to Ireland. Ownership of these intangible assets has been transferred to Irish resident units but they remain ultimately held by the rest of the world. Besides, direct investments by incoming offshore centres in Ireland are significant (€156 billion) when recorded under the immediate investor principle, as in figure V, but much smaller (€49 billion) under the ultimate investor principle (i.e. the ultimate country from which the investments originate, cf. Online Appendix C1-B).

In contrast, the US is an immediate investor in Ireland for €232 billion but is actually an ultimate investor for more than the double (€545 billion).[11] At the same time, Irish resident units increased their outward foreign direct investment by €325 billion between 2014 and 2015; their geographical distribution is different, reflecting the complexity of the reorganization at work. Assets are held for €397 billion by units resident in Luxembourg, €91 billion in the US and €11 billion in the United Kingdom (Figure V). Outward FDI statistics are calculated according to the direct beneficiary principle (and not the ultimate beneficiary), and Luxembourg's share in Irish outward FDI according to this principle reveals MNEs tax and jurisdiction arbitrage.

The change in the net FDI and portfolio investment position between 2014 and 2015 reflects

10. This is consistent also with the fact that the Irish resident unit sheltering Apple*'s relocated intellectual property (which is used for the sales outside the US that are themselves recorded as profits in the Irish resident unit) may have contracted loans towards other* Apple*'s subsidiaries outside Ireland (probably Jersey, see Brehm Christensen & Clancy, 2018).*
11. https://www.cso.ie/en/releasesandpublications/er/fdi/foreigndirectinvestmentannual2018/

Figure V – **Geographical distribution of direct investment in Ireland in 2016 (stocks in billions of euros)**



Sources: CSO, Balance of Payments.

a shift in balance sheets between the rest of the world and Ireland: new entries are simultaneously recorded in the liabilities and assets of resident units. For the most part, these assets do not result from new investments but from changes in the legal and/or geographical allocation of property rights between MNEs' units now located in Ireland.

2. The Measurement Problems Raised by the Irish Case

The extent of Irish GDP growth and the difficulty of rationalizing it as an evolution of national production have been much debated. Krugman (2016) and Fitzgerald (2018) expressed concerns about the source of growth and the economic relevance of such an accounting entry. Few companies were involved, so that the CSO could not give further explanations without infringing the rules of statistical confidentiality, which prevent access to the business statistics underlying the construction of the accounts.[12]

International institutions were immediately concerned with the accounting validity of this unprecedented GDP growth, to check whether it stemmed from misinterpretations of the rules (Stapel-Weber & Verrinder, 2016). The OECD (2016) pointed out in particular the difficulties of interpreting the concepts of resident unit, economic ownership and, overall, the implementation of the national accounting framework in the context of global production arrangements. In addition, the IMF (2016), in view of the assistance program received by Ireland, has paid close attention to Irish macroeconomic statistics.

2.1. Taking Globalization into Consideration in National Accounts

National accounts have gradually developed, taking into account the evolution of the concepts of territory, production and economic units since the second half of the 20th century. The uses of national accounts, the availability of data sources and the need for comparability have all played a role in its expansion (Vanoli, 2002). In particular, national accounts have developed with reference to the model of production by resident units on the national territory. In this framework, international trade is carried out between resident and non-resident companies. Imports and exports ensure that the economy's balance between resources and uses is achieved. Similarly, income transfers linked to the production process – dividends, wages – lead to the correction of GDP to GNI by tracing the balance of primary incomes with the rest of the world.

The Irish case shows that this framework is questioned by the globalization of production chains and situations where production is simultaneously carried out in several countries, organized

12. See https://www.cso.ie/en/aboutus/lgdp/csodatapolicies/statistical-confidentiality/

in a fragmented way, with the circulation of semi-finished products according to sophisticated contractual arrangements, involving off-market trade (at transfer prices between group units) and dissociating the commercial and financial aspects from physical production. The Irish case is made even more complex by the relocation of intangible assets. Therefore, when value added is created, where should it be located by national accounts (Avdjiev *et al*., 2018)?

The System of National Accounts (SNA) does not define the producer as one who physically participates in the production activity but as one who owns the product that is being processed (United Nations Statistics Division - UNSD, 2008). This principle is fundamental because it is the basis for consistency between the production and income approaches. However, this principle leads to the recording of the value added that results from physical production abroad in the country of residence of the owner of the product. For instance, a "factoryless" company that has designed a good but relocated its production uses subcontractors to produce the various elements and assemble them. The production of the various components and assembly can take place in several countries, all potentially different from the producer's country of residence. National accounts then allocate the value added to the "factoryless" producer's country of residence.

2.2. The Role of the Legal Unit

In national accounts, the definition of "domestic" production is based on that of resident[13] institutional units. Resident units are those that have a predominant centre of economic interest in the economic territory of the country. A "centre of economic interest" indicates that the unit carries out economic activities and large-scale operations on the economic territory for an either indefinite or fixed but relatively long period of at least one year (ESA 2010, 1.61). Some resident units may be re-domiciled (CSO, 2016c).[14]

The legal existence of a society does not automatically imply an economic «existence» from the national accounts perspective, the latter corresponding to the concept of institutional unit. According to the ESA (2010, 1.57), "institutional units are economic entities that are capable of owning goods and assets, of incurring liabilities and of engaging in economic activities and transactions with other units in their own right." This definition is detailed in ESA (2.12): "An institutional unit is an economic entity characterized by decision-making autonomy in the exercise of its principal function. A resident unit is regarded as constituting an institutional unit in the economic territory where it has its centre of predominant economic interest if it has decision-making autonomy and either keeps a complete set of accounts, or is able to compile a complete set of accounts."[15] Some subsidiaries within groups are "legal units", but may not be institutional units from national accounting standpoint.

The ESRG (2016) indicates the reasons why Ireland has become the predominant economic focus of subsidiaries receiving intangible assets: *(i)* the units in question are incorporated and registered in Ireland; *(ii)* the staff and in particular the senior management reside there; *(iii)* the units in question compile a complete set of accounts; and *(iv)* they have decision-making autonomy in economic matters. Eurostat's audit also agrees with the nature of resident institutional unit of the entities responsible for the increase in Irish GDP.

Nevertheless, the criterion of decision-making autonomy may remain difficult to establish within a group and sometimes, even in the relationship between a principal and a subcontractor. In the Irish case, whether foreign MNEs that have relocated intangible fixed capital (R&D, patents, etc.) to their Irish subsidiary have or not delegated operational decision-making process in Ireland has been questioned. The complexity of the organization of the MNEs concerned and the statistical secret also introduce uncertainty about the proper understanding of the classification of entities and the relations between them.

2.3. The Implications of the Economic Property Criterion

Since the SNA 2008, national accounts have used the criterion of change of economic ownership to record a transaction. This economic

13. Residence in the sense of national accounting slightly differs from tax residence.

14. Re-domiciliation is the relocation of the headquarters in Ireland of foreign multinationals that previously had only a subsidiary in Ireland, According to the CSO, the re-domiciliation of companies is not the main phenomenon underlying the Irish GDP growth in 2015.

15. "To enjoy decision-making autonomy in the exercise of its main function, an entity must: (a) *be entitled to own property and assets independently; it must be able to exchange ownership of property or assets in transactions with other institutional units;* (b) *have the capacity to make economic decisions and carry out economic activities for which it is held legally responsible;* (c) *have the capacity to enter into commitments, incur debts and other obligations and enter into contracts in its own name;* (d) *have the ability to establish a complete accounting system, i.e. a balance sheet of its assets and liabilities, and accounting documents showing all the transactions it has carried out during the accounting period."*

property is defined as the fact of bearing the benefits and risks associated with the use of an asset in a production. However, in the context of intra-group relations, determining whether a subsidiary enjoys economic ownership of a production is not straightforward (UNECE[16], 2015, 3.11). When economic ownership cannot be unequivocally defined, the legal ownership criterion is used by default.[17] According to the SNA 2008, legal ownership is characterized by the possibility for an institutional unit to "claim, as of right and under the law, the benefits associated with these entities" (UNSD, 2008, 3.21). Thus, while legal ownership corresponds to being able to claim an "advantage" by law, economic ownership consists of being able to claim an "advantage" *(1)* in the context of an economic activity and *(2)* by accepting the corresponding risks and *(3)* in the context of a use (see Online Appendix C1-C, for more details on the concept of legal ownership).

The difference between economic and legal ownership refers to a fundamental principle of national accounts: the distinction between production and income distribution operations. Indeed, production requires the economic ownership of the factors of production – capital and inputs – and of the product, but without all the criteria of legal ownership having to be met, since it may be sufficient to have the right to use the asset and enjoy its product. Conversely, income distribution operations refer to the ability to allocate the income received (related to exploitation, transfer, asset stripping) through legal ownership over an asset. The right of ownership therefore makes it possible to transfer income or risk as in the case of shares or bonds. Indeed, the ESRG (2016) highlights the fact that the relocation of intangible assets has reduced payments from Irish subsidiaries to non-resident units in return for the right to use intellectual property.[18]

Defining economic ownership is even more complex in the case of an intangible asset. Indeed, while the Irish resident unit may own a relocated intangible asset in the legal sense, it is difficult to decide on the origin of the relocation decision (Connolly, 2017). In the Irish case, the resident units receiving the intangible assets simultaneously saw their liabilities towards the rest of the world increase, which indicates that foreign entities keep ultimate control on the relocated assets. UNECE (2015, 3.56) warns in the general case that economic ownership may remain in the hands of a parent company and may never have been transferred to one of its subsidiaries even if the legal ownership of intellectual property has been transferred. In addition, the subsidiary may be a special purpose entity established to receive legal ownership of IPP and/or to centralize the associated income for tax optimization purposes. In this case, because economic ownership would be too difficult to determine without further guidance notably from tax authorities, UNECE (2015) recommends that national accountants record economic ownership in accordance with the legal declarations of the special purpose entity.[19] The distinction between economic and legal ownership therefore appears difficult in the era of transfers of intangible goods, as recognized by UNECE (2015). Frequent ownership stripping situations for intangible assets also contribute to blurring the notion of "economic ownership" based on "use". UNECE (2015) provides a decision tree of to define economic ownership over IPP (p. 50, Figure 4.1), but the criterions remain difficult to assess in the face of complex legal and contractual relationships within groups. Were the classification criterions too "blurry", the determination of economic ownership over IPP would be volatile and subject to disputes. The typical case would be the transfer of patent use rights from a parent company to a subsidiary, as for example under a cost-share agreement (Benshalom, 2006). Although the contractual situation is clear – every stakeholder knows what he can do with regard to the different contractual attributes of the partial transfer of ownership – the economic property as defined by UNECE (2015) needs further analysis. This therefore calls for clarifying and revamping the concept of economic ownership to make it more applicable.

In total, the changes in the Irish GDP in 2015 illustrate the difficulties in interpreting global production arrangements in accordance with national accounting rules, particularly with regard to the concepts of institutional units and economic ownership. By default, the legal

16. The national accountants grouped within the United Nations Economic Commission for Europe (UNECE), already alerted by the developments of cases of international production and their complexity in relation to the simple model of unified production on a single site, have addressed this subject in a guide on the effects of globalization.

17. For practical reasons, because the legal units are entitled to file financial statements. Consequently, it is often necessary to be a legal unit before being a resident economic unit (UNECE, 2012).

18. "In the past, the impact of contract manufacturing activities on exports of goods was largely offset by imports of Research & Development services, as Irish companies made payments to non-resident parts of the group for the use of intellectual property. However, when the intellectual property is located in Ireland, as seen in the results for 2015, these offsetting charges do not occur, and the full effect of contract manufacturing is attributed to GDP." (ESRG, 2016, p. 36)

19. "Applying the principles of economic ownership to such cases, in contrast to legal ownership, would be extremely difficult. National accountants usually have no alternative than to follow reality as reported by these SPEs i.e. recognize them as separate institutional units. Consulting the tax authorities may be a way to obtain a better understanding of the nature of these SPEs." (UNECE, 2015)

criteria of legal units and ownership overtook those of institutional units and economic ownership in the Irish case.

3. Four Ways Forward

GDP and GNI developments in Ireland challenge the economic analysis (sustainability, competitiveness, etc.), by substantially changing the debt and deficit ratios as a share of GDP or altering the computation of multi-factor productivity. They also led to operational uncertainties, for example regarding the increase in Ireland's contribution to the European budget. In this context, Eurostat conducted a methodological audit in 2016, concluding that the existing national accounting rules were respected, and validated the use of the revised Irish GDP in the context of the European excessive deficit or macroeconomic imbalance procedures (Eurostat, 2016a, 2016b). At the same time, the CSO also argued that there were no errors and that the accounting treatment was correct. The CSO mandated the ESRG[20] to consider these new phenomena. In this section, four ways forward are reviewed and discussed starting with the proposals made in the ESRG report.

3.1. New Complementary Indicators

The report contains thirteen recommendations (ESRG, 2016). The main conclusion was that the traditional indicators (GDP and GNI in particular) should be maintained, but that it was also necessary to add, at the same rate of publication, a modified gross national income neutralizing the effects of MNEs on GDP (the so-called GNI*) and a net national income. GNI* equals GNI minus the factor income of re-domiciled companies in Ireland and the consumption of fixed capital[21] on the imports of R&D services and trade in intellectual property[22] and on aircraft leasing in Ireland. GNI* is thus a hybrid concept (neither gross[23] nor net) that requires a separate national account of MNEs' subsidiaries. Indeed, GNI does not correct for all of MNEs' assets relocation, notably because the consumption of fixed capital on some foreign direct investments keeps being recorded in Ireland (Lane, 2017). The earnings reinvested in Ireland, which are removed from GDP to compute GNI, are computed net of consumption of fixed capital; the associated consumption of fixed capital therefore remains recorded in Irish GNI and GDP.

In 2015, the GNI* growth rate was 8.6% – compared to a rate of 26% for GDP. However, there are limits to this indicator. By nature, GNI* is an *ad hoc* aggregate, designed specifically for Ireland. At this stage, GNI* is mainly used by international organizations (IMF, European Commission, etc.) to compute Irish debt ratios for instance. The other users (academics, economic press, etc.) continue to refer to the GDP despite the level shift in 2015. This calls for alternative ways in addition to the publication of new complementary indicators.

3.2. Correcting *ex post* the Macroeconomic Aggregates for MNEs' Operations

A second approach lies in making an *ex post* correction of national accounts aggregates in order to single out the statistical distortion induced by MNEs, so that the resulting aggregates do not reflect the volatility of intangible capital location. Guvenen *et al*. (2017) and Bruner *et al*. (2018) take into account the US intra-group redistribution of income for tax optimization purposes and therefore seek to correct the US national accounts aggregates. Guvenen *et al*. (2017) based their analysis on the following hypothesis: US MNEs can decide to register, at no cost, a fraction of their income in foreign branches with more lenient taxation, by optimizing the registration of the legal ownership of intangible assets. The US shareholders, who ultimately hold these assets, financed and supported the R&D and innovation process, continue to be paid on the income recorded in foreign branches. Nevertheless, in this analysis, such profit shifting should entail a lower US GDP because part of national production is recorded in foreign affiliates and higher income on US direct investment abroad due to reinvested earnings.

To assess what the US GDP would be if profits of US MNEs currently recorded in foreign affiliates in low-tax jurisdictions were to be reallocated to the US rather than "repatriated" via returns on direct investments abroad, Guvenen *et al*. (2017) implement a "formulary apportionment" method similar to that used by tax experts. The

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20. The ESRG, which brought together several stakeholders in these debates - academics, administrative and Eurostat and IMF experts - had the task of better assessing the effects of globalization on indicators derived from national accounts and the balance of payments. On this topic, see also Holton et al. *in this issue.*

21. In national accounts, consumption of fixed capital is roughly equivalent to depreciation in private general accounting.

22. The difference between GNI and GNI in 2015 almost exclusively stems from the correction for the consumption of fixed capital on the imports of R&D services and trade in intellectual property, that is consistent with a massive relocation of intangible assets. It amounts to roughly €30 billion.*

23. Gross refers to an aggregate that includes consumption of fixed capital (i.e. depreciation of assets), unlike net aggregates.

"formulary apportionment" consists in allocating the global profits of a MNE according to *(i)* the share of the wage bill represented by the country at stake in the MNE's total wage bill, and *(ii)* the share that the country represents in terms of sales to non-affiliated entities made by the MNE. The results obtained are not sensitive to the choice of criteria *(i)* or *(ii)* for ventilation. Although the study concluded that 65% of the returns on direct investment abroad are reassigned to US GDP, the final impact on GDP remains limited in the case of the US: over 2004-2014, this adjustment amounts to an average of $260 billion per year, roughly an annual 1.5% of 2014 GDP. However, a correction of the same magnitude would have substantial consequences for smaller economies, and in particular for Ireland. Guvenen *et al*. (2017) also estimate that $30 billion of the total amount reallocated to the US GDP based on their correction would come from Ireland, which represents about 13% of the Irish GDP in 2012. A recent statistical analysis estimates an even greater volume of profits shifted to Ireland, at around $117 billion in 2015 (Tørsløv *et al*. 2018)

Although promising, the *ex post* adjustment of macroeconomic aggregates is not without vulnerabilities. Suarez-Serrato (2018) shows that, following the repeal of the provisions in the Internal Revenue Code which enabled the US MNEs to shift profits to affiliates in Puerto Rico, the MNEs reacted to the increase in their overall tax burden by reducing employment and investment in the US, and increasing investment in their foreign subsidiaries. Changing the tax system therefore affects MNEs' organisation, and *ex post* correction of macroeconomic aggregates cannot sufficiently account for such feedback loops. Correcting *ex post* GDP also requires a review of the entire sequence of accounts to ensure consistency (Bruner *et al*., 2018). From a statistical point of view, the "formulary apportionment" method also requires detailed data on the activities and country-by-country financial statements of each entities of MNEs. Above all, Guvenen *et al*. (2017) or Bruner *et al*. (2018) aimed at providing an order of magnitude of profit shifting but did not suggest the release of adjusted statistics by national statistical institutes on a regular basis.

3.3. Changing the Rules of National Accounts

Lequiller (2019) paved a third way forward by urging a change in national accounts rules. He acknowledges that the 2015 Irish unprecedented growth, whose cause is a balance sheet movement rather than new production, illustrates that current rules can lead to a measure of GDP inconsistent with its use as an indicator of national production. Lequiller (2019) suggests to exclude R&D or software assets from capital and investment as it was the case in the previous manual of national accounts (SNA 1993). Lequiller (2019) also hints at the difficulty of distinguishing between production and financial operations and thus proposes to exclude "goods for processing" from transactions. In the same vein, Tedeschi (2018) advocates for a separation of the entire "offshore sector" of the Irish economy.

However, these proposals overlook intangibles as a source of economic growth. Recording intellectual property assets makes it possible to identify their contribution to value added in the analysis of productivity. Moreover, as pointed by Ahmad *et al*. (2018), production is generated through the use of R&D whether or not recognized and capitalized as such in the national accounts. Should national accountants stop capitalizing intangible assets, the income derived from these assets would still exist, but would not properly be explained by the traditional factors of production. In total, excluding intangible assets would have led to a more modest GDP growth in 2015 but does not address the economic issue of profit and revenue shifting at stake in Ireland.

Reviewing the current national accounting rules to provide a consistent recording of the global activity of MNEs resorting to profit shifting appears necessary: globalization is now one of the major topics on the agenda of the international System of National Accounts. However, we should focus on a clarification of the concept of economic ownership over production and intellectual property rather than removing/decapitalizing the latter.

3.4. Including Intangible and Mobile Capital in Production Functions

The Irish GDP growth in 2015 draws attention to an increasing difficulty in the analysis of aggregate production. Standard economic theory provides a guidance about the way to locate production only in an extreme case by assuming a linear production function (i.e. making the inputs separable or perfectly substitutable, see Online Appendix C2). How to deal with an increase in production that does not result from an increase in traditional factors of production such as employment, hours worked or physical capital? Moreover, in usual business

cycle analysis, the GDP level is explained by the demand fluctuations in relation to potential GDP. Traditionally, potential GDP depends of three components: the volume of hours worked – determined by demographic factors and the labor market –, the available capital – determined by investment – and multi-factor productivity – its determinants including levels of training, market organization and technological progress –. In the short term, these factors cannot change significantly. The novelty of the Irish case is that rapid and persistent movements in GDP are due to changes on the supply side in relation to the international mobility of intangible capital.

Integrating intangible capital, which is in essence more mobile, into business cycle models makes it possible to account for the rapid movements in an economy's supply, but not without difficulties (Corrado *et al*., 2009). First, intangible capital is not easy to define and measure (Thum-Thysen *et al.*, 2017). The problem of its valuation is acute, particularly because intangible assets are generally not traded on markets between independent players, but are the subject of intra-group transactions (Dischinger & Riedel, 2011). It depreciates more quickly than physical capital, and loses market value in the case of a patent that has fallen into the public domain. In addition, the inclusion of intangible capital poses a problem in estimating potential output, where the inclusion of physical capital already makes it difficult to estimate multi-factor productivity.

However, macroeconomic models incorporating intangible capital address issues such as changes in the labor share, corporate profitability differentials between home companies and foreign affiliates or gains from trade. For example, Koh *et al*. (2016) show that the decline in the labor share in the value added in the United States over the past 65 years is almost entirely due to the relative increase in the remuneration of intellectual property, while the share of traditional physical capital remuneration is stable. McGrattan & Prescott (2010) also develop a multi-country general equilibrium model that integrates an intangible capital called technological capital that is exclusive (i.e. cannot be used outside the MNE that owns it) but non-rival (i.e. can be used simultaneously by all entities belonging to the MNE). Their model allows them to explain 60% of the gap between the return on investment of American MNEs on their direct investments abroad and the return on investment of foreign MNEs in the United States. Using the same theoretical framework, Kapička (2012) explains and quantifies the movements of indirect investment abroad in the US the gains from trade.

Including intangible capital in an aggregate production function therefore makes it possible to understand movements in GDP but shifts the focus to the determinants of the allocation and accumulation of intangible capital within each country.

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The case of Ireland in 2015 is a telling illustration of the challenges posed by globalization to the measurement of economic activity, since part of the income and some factors of production are extremely mobile across jurisdictions. In particular, intangible assets such as patents or customer personal data play a major role in the new volatility of income. Besides, significant developments in GDP may result from restructuring within or between a few large groups.

So far, the national accounts rules face operational difficulties in their implementation, or in the availability of sources, but also in the interpretation of some of its core concepts such as economic ownership. In the case of Ireland, the GDP indicator has deviated from the measurement of production on the national territory. This step aside from the objectives traditionally assigned to GDP is all the more significant that the economy is "small" and "open", as is the case for Ireland. Consequently, national accounts are the subject of intense debate on how to take into account global value chains following UNECE (2015), for instance with respect to the definition of economic ownership, ownership over intellectual property products and control within multinationals. The alternative proposals that have emerged so far are either not fully satisfactory or not yet implemented and fully ripe. A continuous effort to adapt and revamp the standards of national accounts is thus necessary to achieve a consistent recording of transactions within MNEs, crucially by clarifying the concept of economic ownership over production and IPP, and by making it more applicable. This requires enhanced further exchange of information on MNEs between national accountants across countries. This effort should not aim at providing an *ad hoc* smoothing of macroeconomic aggregates in the manner of the GNI*, because the increased volatility of data series also inform on profound changes in economies,

for instance the increasing role of MNEs, and tax or legal competition across countries.

Even after the US tax reform of 2018, which aimed at reducing the tax base erosion and profit shifting in a context of international fiscal competition, the Irish statistical office continues to record new asset transfers. In the second and fourth quarter of 2019, Irish subsidiaries have become the new owners of intellectual property assets transferred from foreign subsidiaries within large groups. As a result, investment and imports surged in the Irish quarterly accounts. A phenomenon of a comparable order of magnitude on Irish investment and imports had already taken place in the quarter second 2017. The systematic approach of the 2015 Irish episode therefore paves the way for further research on the effect of localization of intellectual property products on GDP. □

Link to Online Appendices: https://www.insee.fr/en/statistiques/fichier/4770164/ES-517-518-519_Khder-etal_Online_Appendices.pdf

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